WORLD STANDARD

MODEM WS2000

User Manual

A low-cost multi-speed multi-standard modem with options of auto-answer, auto-dial and full computer-driven software control. Designed for Viewdata, Telex, User-User, Timesharing and International data communication.

V 21 compatible	300 bit/s Full Duplex
V 23 compatible	600 bit/s Half Duplex
V 23 compatible	1200/75 bit/s Viewdata Terminal
V 23 compatible	75/1200 bit/s Viewdata Host
BELL 103 compatible	300 bit/s Full Duplex
BELL 202 compatible	1200 bit/s Half Duplex

Designed and manufactured in England by
Miracle Technology (UK) Ltd

CONTENTS

FOREWORD

This manual applies to the Miracle Technology (UK) Limited Modem WS2000, in versions from Issue 7. These may be identified by the presence on the front panel of a Rx DATA indicator LED. Previous versions were not fitted with this indicator.

It is important that before the Modem is used, the parts of this manual concerned with WIRING THE MAINS PLUG and with BASIC OPERATION are carefully studied.

The Miracle Technology (UK) Ltd Modem WS2000 is approved for use on telephone systems run by British Telecom only when the modem is used as described in these instructions for use. The Approval Number is S/2637/3/E/500087.

The approval of this modem for connection to the British Telecom public switched telephone network is INVALIDATED if the apparatus is subject to any modification in any material way not authorised by BABT (the British Approvals Board for Telecommunications) or it is used with or connected to external control software or external control apparatus which causes the operation of the modem or associated call set-up equipment to contravene the requirements of the standard set out in BABT/SITS/82/005S/D. All apparatus connected to this modem and thereby connected directly or indirectly to the British Telecom public switched telephone network must be approved apparatus as defined in Section 16 of the British Telecommunications Act 1981.

It is important to note that only apparatus complying with BS6301 may be connected to the socket on the back of the modem marked TELEPHONE. This port is clearly marked "WARNING: connect only apparatus complying with BS6301 to this port".

If you need any further assistance in the use of this modem, please contact the dealer from whom you bought the modem, or alternatively write to

Miracle Technology (UK) Limited
10-12 St Peters Street
Ipswich England

enclosing a self-addressed reply paid envelope

0473 ~~51785~~
216141

Section 1

MODEM CONNECTIONS

1.1 Carefully unpack the modem, and check that you have received:

1 WS2000 modem
1 Instruction manual
1 Form with which to tell British Telecom if you need a socket fitted to suit the modem plug (the form is included at the rear of this manual)

Any connecting leads you may have ordered.

1.2 The modem requires a mains supply of 220/240 V (alternating current) 50/60Hz at 15 watts. No mains earth is required, as the unit is double insulated.

The mains cable contains two cores, one coloured BROWN, the other coloured BLUE.
The BROWN wire is to be connected to the pin on the mains plug marked L or LIVE, and the BLUE lead is to be connected to the pin on the mains plug marked N or NEUTRAL. No connection is to be made to the mains plug pin marked E or EARTH.

THE MAINS PLUG MUST BE FITTED WITH A FUSE RATED AT 3 AMPERES. Such a fuse may be marked 3A or 3/250. If a 13-ampere fuse is already fitted in the mains plug this fuse MUST be removed and replaced with a 3-ampere fuse.

1.3 The WS2000 is provided with a lead type 4/502 to connect to the standard British Telecom type 600 telephone jack socket. The plug terminating this lead is known as a type 431A. If you do not have a suitable socket fitted, then you must ask British Telecom to fit a socket for you. Please use the enclosed Post Card for this purpose.

If you have a suitable socket, then you may fit the telephone plug to the socket.

In order to do this, you may have to remove any telephone device already installed in that socket. There is a socket on the rear of the WS2000 modem to which the displaced device may be fitted; this socket is wired in parallel with the standard telephone socket, and the use of the normally fitted device will not be affected, except when the modem is actually On Line.

1.5 On the rear panel of the modem is the statement REN=1. The letters REN stand for Ringer Equivalence Number, and the number 1 means that this modem, when fitted to a British Telecom line in parallel with two other similar devices — for instance a main and an extension telephone, or a telephone and another similar modem — will not affect the ringing characteristics of the other devices. The modem has been approved for such a connection, though this does not necessarily mean that it would have any adverse effects on the operation of a larger number of devices if connected in parallel with it.

The WS2000 modem is suitable for connection to two-wire telephone circuits, or, where the loop-disconnect dialler option is fitted, to three-wire telephone circuits.

The WS2000 modem should not be used in conjunction with a payphone. It may be used on either loop-disconnect or MF tone dialling circuits.

Equipment with unmarked ports should not be connected to the WS2000 modem in case hazardous voltages may be placed on the telephone line under fault conditions. If you are unsure of whether a piece of equipment may be connected to this modem, you should seek the advice of a competent engineer.

1.4 The third essential connection is to the terminal or computer in use. The WS2000 is fitted with a standard 25-way female socket at the RS232 port, and this socket will be compatible with the majority of terminal devices. The wiring of this socket is given in Section 7 of this manual, and if a special cable is needed Miracle Technology (UK) Limited will be able to supply it. If you want to buy the necessary plug for the RS232 socket, you should ask for a DB25 male plug with solder connections and standard hood.
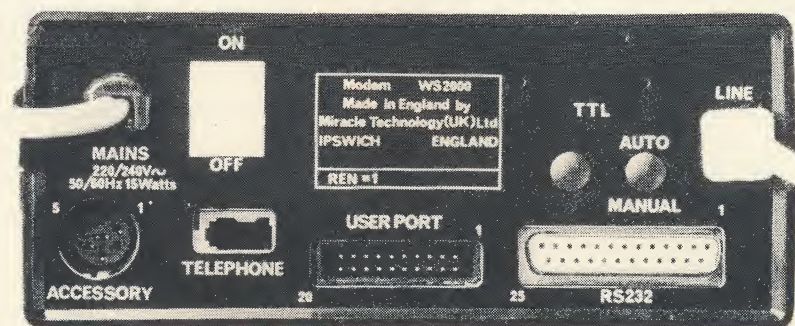
Rear panel layout

Section 2

INITIAL TESTING BEFORE USE

2.1 It is important that you check that the modem and terminal/software combination is functioning correctly before you attempt to use the modem On Line.

The modem has a number of knobs and function indicators on the front panel. These include LED indicators for

Power On
Tx (transmitted) Data
Rx (received) Data
Data Carrier Detected
On Line warning

The large knob on the right is used to select the Mode of operation.

2.2 PLEASE NOTE THAT IF YOUR WS2000 MODEM HAS BEEN SUPPLIED FOR USE IN A COUNTRY WHERE BRITISH TELECOM REGULATIONS APPLY, THEN A STOP WILL HAVE BEEN FITTED TO THIS KNOB TO PREVENT THE USE OF THE AMERICAN BELL STANDARDS. THIS IS A REQUIREMENT OF BRITISH TELECOM, TO PREVENT INTERFERENCE WITH CERTAIN DIALLING SYSTEMS. IF YOU INTEND TO USE THE MODEM ONLY OUTSIDE THE AREA COVERED BY BRITISH TELECOM REGULATIONS, THEN IT IS POSSIBLE TO HAVE THIS STOP REMOVED. FOR ADVICE ON HOW TO HAVE THIS DONE YOU SHOULD INFORM MIRACLE TECHNOLOGY (UK) LIMITED THAT YOU WILL BE USING THE MODEM ONLY OUTSIDE BRITISH TELECOM AREAS, AND REQUEST THE NECESSARY INFORMATION.

2.3 The Modes of operation available are as shown in figure 1, which illustrates the front panel. The darker coloured wording indicates modes of use not immediately available, except with extra hardware fitted in the modem, or in areas outside British Telecom jurisdiction.

IMPORTANT Note that after changing a Mode setting, the DTR line must be taken OFF (low) then ON (high) again to reset the modem's internal firmware. Failure to do this may cause unpredictable operation.

2.4 The top rotary switch is Switch 2, or SW2. This switch selects whether the modem is set for Viewtext (Prestel, Micronet, Telecom Gold etc) or for other services such as Bulletin Boards or Easylink Telex. The upper position, marked Viewtext, sets the modem to receive data at 1200 baud, and transmit data at 75 baud. The lower position, marked 300/300, sets the modem to receive and transmit at 300 baud. The lower position is also used for transmission and reception at 600 or 1200 baud in half duplex mode, and for "reverse Viewtext" where the WS2000 may be used to emulate a Viewtext database, running at a modem transmit rate of 1200 baud and receive rate of 75 baud.

2.5 The lower rotary switch, SW1, is used to switch the modem On Line, which is the position used when actually engaged in a data exchange over the telephone line; at all other times this switch will be in the Local Test position, which sets the modem to a self testing mode.

CHECKING OFFLINE MODEM OPERATION

2.6 With a terminal or computer connected to the modem, the data rate set at 300 baud full duplex, and the necessary software, for 300 baud full duplex use running, set the switches to the positions shown in Figure 1 below.

Now, with the modem switched on, when you press a key on the keyboard, the character pressed should be printed on the screen. If you switch the modem off, the character should no longer be printed.

2.7 If nothing happens, check all your settings and connections before referring to the Faultfinding section of this manual for advice.

2.8 If the above test is satisfactory, you can also, if you wish, test your Viewtext settings. Set the modem switches to the positions shown in Figure 2. Set your computer data rates to 75 baud receive, 75 baud transmit. Again, when you press a key with the modem switched on, that key character should be printed on the screen. If not, check all connections and settings carefully, or refer to the Faultfinding section. Note that the Viewtext test settings are different to those used for normal Viewtext communication. *PLEASE REFER TO THE IMPORTANT NOTE ON PAGE 16 REGARDING THE USE OF THE V23 TEST SETTING.*
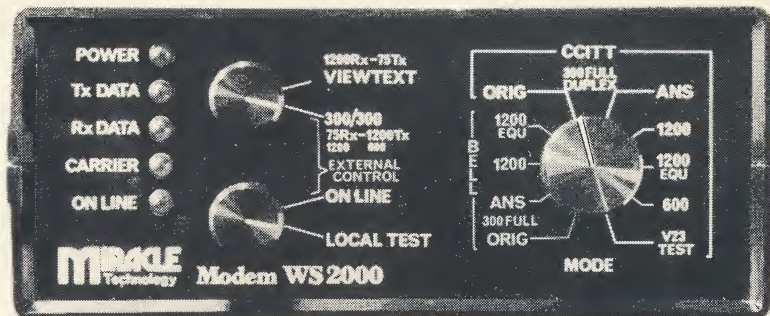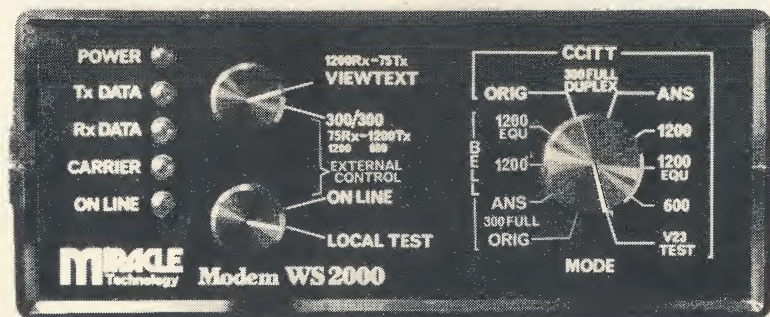

Figure 1 (above)

Figure 2 (below)

Section 3

ONLINE USE: VIEWTEXT

3.1 To communicate with a Viewtext database such as Prestel, Micronet or Telecom Gold, set the modem switches as shown in Figure 3.

3.2 Your computer will need to be running at 1200 baud receive, 75 baud transmit, and for the graphics based databases such as Prestel and Micronet, will need specialised software. Normal communications software can be used for text based databases such as Telecom Gold.

3.3 With the modem Off Line, check operation with the tests of Section 2.8. If all is well, still with the modem Off Line, dial up the database you want. Listen at your telephone handset for the carrier tone from the database. When you hear the carrier tone in the handset, switch the modem On Line at SW1. Listening at the telephone handset, you should now hear a stream of data bits transmitted from the distant computer, and see data printed on your computer screen. Carefully replace the handset on the telephone — the modem has "seized" the line and will hold it.

3.4 As you replace the handset, you will probably see some "data corruption" on the screen, due to the noises you made on the telephone when replacing the handset. These should quickly clear to give "clean" reception.

You should now be in two-way communication with the database, and you can continue like this until you want to end, when you simply turn the modem SW1 to the LOCAL TEST position which will disconnect the modem from the telephone line.

3.5 During the data link the front panel LED indicators should show:

Power ON
Tx Data Flashing when you press a key
Rx Data Flashing when data is sent to you
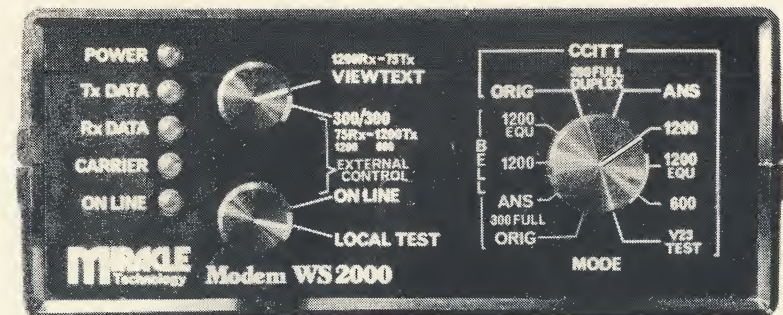Carrier ON
On Line ON

Figure 3

Section 4

ONLINE USE: BULLETIN BOARDS

4.1 Bulletin Boards are normally accessed at 300 baud full duplex, though some are now using 1200/75 baud as in Viewtext. For 300 baud access set the front panel switches to the positions shown in Figure 4 below.

4.2 Your computer should be set to 300 baud full duplex, and you will need software for 300 baud full duplex terminal use.

Go through the test procedure in Section 2.6, then dial up the bulletin board exactly as described in Viewtext accessing, Sections 3.3 to 3.5. The only additional information needed is that many bulletin boards look for you to send them a Carriage RETURN or two before they will send you data.

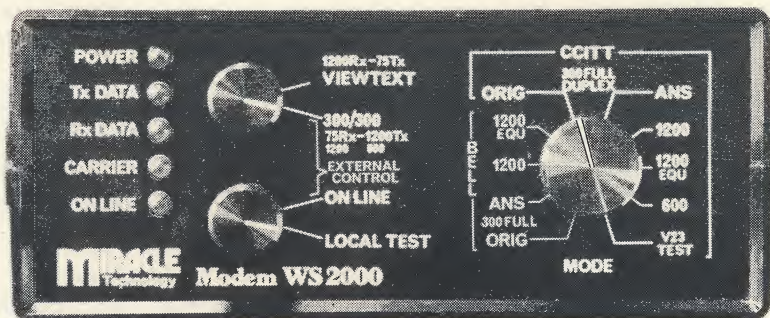4.3 Any problems may be cured by reference to Faultfinding, Section 6.

Figure 4

Section 5

ONLINE USE: USER TO USER

5.1 The WS2000 modem is very versatile in the number of modes available for user-to-user communications. The most used mode is 300 baud full duplex, but 600 baud half duplex, 1200 baud half duplex, and 1200/75, 75/1200 baud full duplex may also be used.

300 BAUD FULL DUPLEX

5.2 300 baud full duplex use is dependant upon one person starting the data link — he will be the one to ORIGINATE the call — and another receiving the data — he will be the one to ANSWER the call. The person originating will set his switches as in Figure 5. The person answering will set his switches as in Figure 6. The data link is set up exactly as in Sections 3 and 4, by the originator telephoning the answerer, and both putting their modems on line.

5.3 NOTE that it is not necessary to switch the mode switch between Originate and Answer during the data link; the modem looks after this entirely automatically.
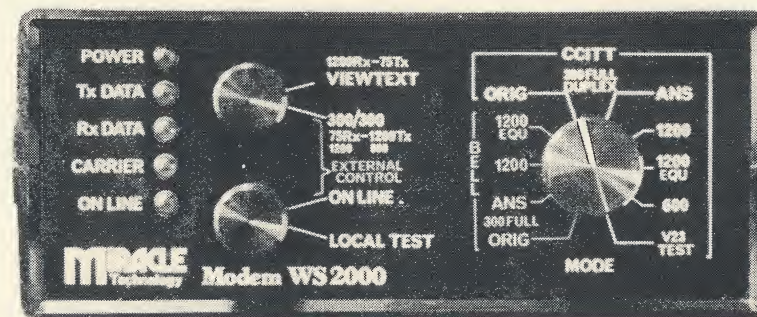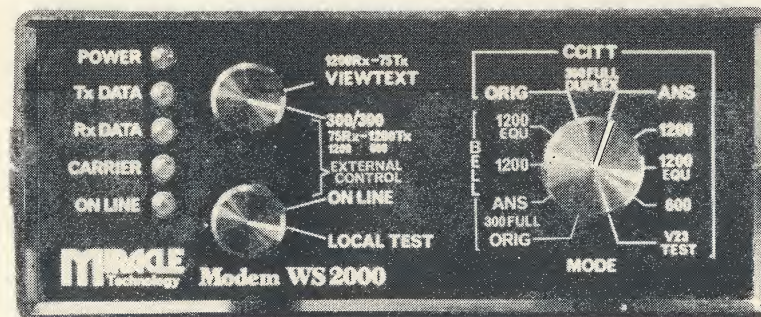

Figure 5 (above)

Figure 6 (below)

600 AND 1200 BAUD HALF DUPLEX

5.4 For 600 baud half duplex operation, set the switches as in Figure 7, and for 1200 baud half duplex use as in Figure 8.

5.5 Half duplex operation means that information can be sent in only one direction at a time. Therefore, a means must be provided for each end of the link to be able to switch between transmitting and receiving. This may be done by:

A. Using the top rotary switch, SW2. In the lower switch position the modem will transmit at 1200 baud, and in the upper switch position it will receive at 1200 baud.

B. Using the Request To Send (RTS) line of the RS232 port to control transmission. When RTS is ON (or high) then the modem will be in a transmit mode, and when RTS is OFF the modem will be listening or receiving. When receiving, the carrier will be off. Software control of Tx/Rx can therefore be by the transmitting end sending a control code when it completes transmission, the code advising the receiving end to go into transmission mode by raising RTS, while the transmitting end switches itself to receive by dropping RTS. Or, a much nicer method is as in C. below.

C. When RTS is dropped the modem switches off its carrier signal as it goes into receive mode; this loss of carrier can be immediately detected by the receiving end, and used to turn the RTS line ON. When the computer currently transmitting ends its sending, the software can drop the RTS line, thus dropping carrier, and signalling the other end to switch from receive into transmit mode.

5.6 Half duplex operation, particularly at 1200 baud, can in fact be highly efficient, and is often equally as efficient in terms of time as a full duplex link, since there is minimal data corruption compared to a 1200 baud full duplex link on the public telephone system.
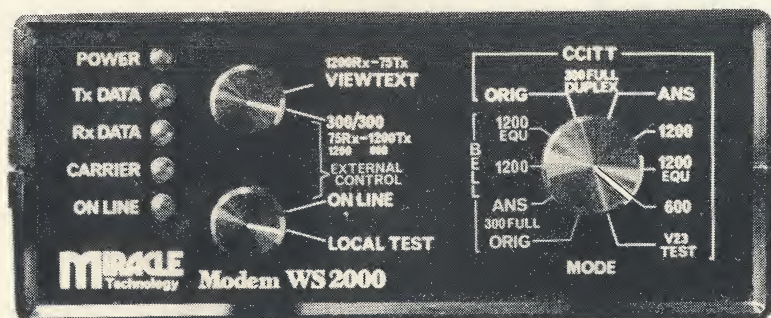

Figure 7

1200/75 and 75/1200

5.7 The WS2000 modem can operate at both 1200 baud transmit and 75 baud receive, full duplex, and the reverse of this, 1200 baud receive and 75 baud transmit, full duplex.

So one end of a data link may be a modem using the standard Viewtext setting of 1200 baud receive, 75 baud transmit, and the other end may be a WS2000 operating the reverse settings. This means that a WS2000 may be used to communicate user to user, in full duplex, with such devices as Prestel and Micronet Adaptors, many of which can normally only be used for Viewtext database applications. The settings for using a WS2000 to communicate with a standard Viewtext Adaptor are as in Figure 8.

5.8 It should be noted that software may need to take account of the protocols used by some Viewtext Adaptors, which are designed with inbuilt software for Prestel only. Parity errors — often appearing as squares printed instead of characters — are the usual signal that software word length or parity alterations are needed.
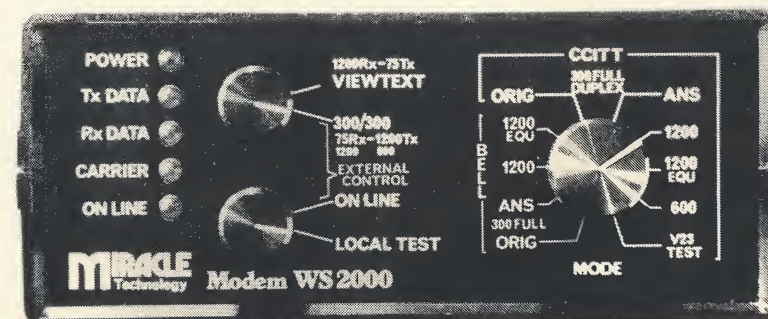

Figure 8

Section 6

FAULTFINDING

6.1 It is a fact that the vast majority of apparent failures to complete a good data link are due to operator or software error. Only in a very tiny percentage of cases will the WS2000 modem be at fault. This is not intended as any claim for an unusually outstanding modem, but as a statement that most failures are due to things other than the modem.

The factors involved in a data link are many and complex, and it is essential that if you think something is wrong, you first GO BACK TO THE SECTION OF THIS INSTRUCTION MANUAL DEALING WITH THE KIND OF DATA LINK YOU ARE TRYING TO MAKE, READ THE SECTION VERY CAREFULLY, AND TRY AGAIN!

If you still have no success then here are the most common problem areas:

6.2 No data being sent from the WS2000 to the distant modem. May be caused by a different wiring standard in use in the RS232 connecting lead. Normally pin 2 of the RS232 socket is for Transmitted Data, and pin 3 for Received Data. But these may be transposed in some cases. To check, set the modem up as in Section 2 for initial testing, press keys on the keyboard, and look for the Tx DATA indicator to flash as you press a key. If it does not, then you should try changing over the wires in your computer to modem lead at pins 2 and 3 at the modem end. Test again.

6.3 Another reason for the fault in 6.2 may be your software holding the DTR or RTS lines at the wrong levels. To use the modem at all, DTR must be ON, or high. RTS must be ON to transmit. Both these lines, if not connected to an external computer, will be held ON internally by the WS2000. A quick check for wrong handshake line status may be done by setting modem and computer ready to use, as if in communication with a database, but the modem is left in Local Test mode. With no keys pressed, the front panel indicators should be

Power ON
Tx DATA OFF
Rx DATA OFF
CARRIER ON
On Line OFF

If the CARRIER indicator is OFF, pull out the RS232 plug from the modem rear socket. If the CARRIER indicator now comes ON this indicates that either DTR Or RTS is being pulled OFF by the computer when it shold be ON. Reconfigure the software to correct the problem.

6.4 Failure to successfully link with the distant modem, despite correct tests in 6.2 and 6.3 is normally caused by software faults. If you pick up the telephone handset and listen on it while the modem is On Line and ready to use, you will be able to hear a sound each time a key on the computer is pressed. The modem must be On Line, not in Local Test. You will hear the data carrier varying in frequency as a key is pressed. This can prove that data is leaving the modem. If it is apparently not being received by the distant modem, check you are sending at the correct baud rate. The sound you hear in the telephone handset should be a very low-pitched carrier, almost a hum, for the Viewtext setting, and various much higher-pitched carriers for the other settings.

6.5 Failure to receive data can be checked by listening on the telephone as in 6.4. If you can hear data coming to your modem, and the Rx DATA indicator flashes as the data is received, then if the data does not appear on your screen it is almost certainly your software at fault.

6.6 Incorrect setting of the top rotary switch, SW2, is often the cause of a failure to link up. Check that the setting of this switch is as described for the operation you want.

6.7 Incorrect or unpredictable operation, particularly where the Rx DATA or CARRIER indicators come ON at the wrong times,is probably caused by a failure to drop DTR after Mode changes. The WS2000 modem contains a microprocessor to control its many internal operations, and the software in the microprocessor must be reset after any change of Mode. After changing Mode, DTR must be taken OFF then ON again — the time period OFF is not important — to reset the software for correct operation. This applies both in On Line and Local Test setups after ANY Mode change.

6.8 Occasionally it is found that after turning the modem On Line, the line may be dropped when the telephone handset is replaced. This points to a problem with the users telephone line, where insufficient current is available to successfully hold the line. The advice of British Telecom should be sought.

Section 7

PORT CONNECTIONS

7.1 The RS232 port on the WS2000 rear panel is wired according to the standard RS232 recommendations. The port is numbered as in Figure 9, with the following pins used:

1   Protective Ground
2   Transmitted Data
3   Received Date
4   Request To Send
5   Clear To Send
6   Data Set Ready
7   Signal Ground (Common Return)
8   Data Carrier Detector
20 Data Terminal Ready
22 Ring Indicator

7.2 USER PORT. This port is used to control many of the functions of the WS2000 from an external computer or piece of control apparatus, under software control. The use of this port is only relevant where any, or all, of the Software Control Set SK1, the Autodialler AD2, or the Auto Answer Board AA2 from Miracle Technology (UK) Ltd has been fitted to the modem. IT IS IMPORTANT TO NOTE THAT THESE ACCESSORIES MAY NOT YET HAVE RECEIVED APPROVAL FROM BABT FOR USE IN THIS MODEM. THE USE OF UNAPPROVED ACCESSORIES WOULD INVALIDATE BABT APPROVAL FOR THE WHOLE MODEM. Numbering of the port is given in Figure 10, and the pin wiring is:

3   Line detect system A
13 Back channel enable
14 Enable software control   SOFTWARE CONTROL
15 Clear to start point
16 Step through Modes

17 Short Line
18 Line detect system B
19 Seize line enable
20 Dial impulse   DIAL/LINE CONTROL
12 Line audio enable
6   Signal ground
11 Future expansion

7.3 Software Control Set SK1 enables virtually all control of the modem functions to be passed to an external computer, acting entirely under software control. All Modes (excepting those not allowed by British Telecom regulations) may be selected and switched between; the modem may thus be set up to detect incoming calls at any data rate, and switch, under computer control, to the correct rate. Full control through software is given of On/Off Line situations, with full safe off line default upon system failure.

7.4 Autodialler AD2 allows full software controlled autodialling of numbers stored in the computer's memory, with audible warning of line status, and computer-driven full auto log-on to databases etc.

7.5 Auto Answer Board AA2 allows the WS2000 to be used as a Bulletin Board or Viewtext Host modem, with full remote answer facilities, and auto disconnect on loss of carrier or under terminal direction.

7.6 Also available is kit TTL1, giving TTL level RS232 port signals at an optional 9-way DB socket fitted to the rear panel. This allows full use with computers such as the Commodore 64 and VIC 20 which only have TTL level ports.

7.7 Further information on these and other accessories for the WS2000 modem may be obtained from your dealer, or direct from Miracle Technology (UK) Limited.

7.8 ACCESSORY Port. This is a 6-way DIN socket for future expansions of the WS2000, including an Acoustic Coupler and Battery Back-Up pack.

Section 8

TECHNICAL INFORMATION

8.1 Dimensions and weight
Width   155mm
Depth   160mm
Height   70mm
Weight   1Kg approx.

8.2 Colour/Finish
Textured ABS high-impact case, panels in black with white and red legends

8.3 Environmental conditions
Ambient temperature range: +5 degrees C to +30 degrees C
Relative humidity range 38% to 85%.

8.4 Power requirements
Nominal 220/240 V 50/60Hz single phase. Power consumption 15 watts.
110 V conversion available.

8.5 Modulation method
Voiceband Asynchronous Frequency Shift Keying

8.6 Data Signalling Rates
300/300 baud, 600 baud, 1200 baud, 1200/75 baud, 75/1200 baud.

8.7 Standards
Compatible with CCITT V21, CCITT V23 and (where allowed by regulations)
BELL 103/113/108, BELL 202.

8.8 Mode Selection
By front panel rotary switch or by external TTL level control. All Modes selectable
externally through User Port when appropriate hardware fitted.

8.9 Transmission Path
2 or 3-wire Public Switched Telephone Network. Approval has also been granted
for the use of the WS2000 Modem on approved PABX systems.

8.10 RS232 Port
Interface RS232/CCITT V24 compatible including Protective Ground,
Transmitted Data, Received Data, Request To Send, Clear To Send, Data Set
Ready, Signal Ground, Carrier Detection, Data Terminal Ready, Ring Indicator.

8.11 Equalisation
Selectable fixed line-amplitude equalisation in 1200 baud modes.

8.12 Test facilities
Full inbuilt analogue self-testing in off-line modes.

8.13 Panel indicators
Power, Tx DATA, Rx DATA, Carrier, On Line.

8.14 External control
Control of all Modes of operation available from User Port, when appropriate
accessory hardware fitted. Autodialling, Autoanswer, TTL level interfacing,
battery backup, acoustic coupling, process control I/O interfacing, all available at
rear panel ports, when fitted. Accessories may be subject to further BABT
approvals as mentioned in paragraph 7.2.

8.15 IMPORTANT NOTE. The V23 Test setting on the modem Mode switch is
subject to a strict BABT regulation as follows: The V23 Test setting applies only to a
test of the V23 back channel when the WS2000 modem is in the Off Line, LOCAL
TEST setting. Therefore it is only to be selected when an off-line test of the modem
is required. It is only to be selected when the upper rotary switch is in the V23
position, that is, in the upper, Viewtext position, and the modem lower rotary
switch is in the Local Test, Offline, setting. To select the V23 test in a non-V23, On
Line modem setting can result in signals outside the allowed frequency spectrum
being placed on the telephone line, and would therefore INVALIDATE BABT
APPROVAL OF THE WS2000 MODEM. Only use the V23 Test position for off-line
testing.

8.16 Fuses
Two fuses are fitted within the WS2000. Neither is accessible to the user, and
failure of either would mean taking the modem to your dealer for the work to be
done. Should either fail, the types of fuses needed for replacement are: FS1
100mA, FS2 300mA, both antisurge. There are no user serviceable parts inside the
WS2000 modem, and if the user opens the case, this would invalidate BABT
approval. Only the manufacturer or his agent should open the case.

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